BEST AVAILABLE IMAGES

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images may include (but are not limited to):

- BLACK BORDERS
- TEXT CUT OFF AT TOP, BOTTOM OR SIDES
- FADED TEXT
- ILLEGIBLE TEXT
- SKEWED/SLANTED IMAGES
- COLORED PHOTOS
- BLACK OR VERY BLACK AND WHITE DARK PHOTOS
- GRAY SCALE DOCUMENTS

IMAGES ARE BEST AVAILABLE COPY.

As rescanning documents *will not* correct images, please do not report the images to the Image Problem Mailbox.

What Is Claimed Is:

1. A fluid pressure reduction device comprising:

a plurality of stacked disks having a perimeter and a hollow center aligned along a longitudinal axis;

each disk having at least one flow path extending between the hollow center and the perimeter, the flow path including an inlet section, an outlet section, and an intermediate section extending between the inlet and outlet sections;

each flow path intermediate section including a pressure reducing structure and a recovery zone positioned immediately downstream of the pressure reducing structure.

2. The fluid pressure reduction device of claim 1, in which the pressure reducing structure comprises a pair of abrupt direction changes in the flow path.

3. The fluid pressure reduction device of claim 1, in which the flow path intermediate section comprises a plurality of flat leg portions.

4. The fluid pressure reduction device of claim 1, in which opposing walls of the flow path intermediate section gradually diverge from one another as the flow path intermediate section advances from the inlet section to the outlet section.

5. The fluid pressure reduction device of claim 1, in which the pressure reducing structure comprises a restriction.

6. The fluid pressure reduction device of claim 5, in which the restriction comprises a first ridge extending from a first wall of the flow path.

7. The fluid pressure reduction device of claim 6, in which the restriction further comprises a second ridge extending from a second and opposite wall of the flow path.

8. The fluid pressure reduction device of claim 7, in which the first ridge extends farther into the flow path than the second ridge.

9. The fluid pressure reduction device of claim 7, in which the first and second ridges are offset so that the first ridge is positioned upstream of the second ridge.

10. The fluid pressure reduction device of claim 1, in which each flow path comprises multiple pressure reducing structures in the intermediate section and an associated recovery zone positioned immediately downstream of each pressure reducing structure, wherein each pressure reducing structure and recovery zone pair effects a pressure drop stage.

11. The fluid pressure reduction device of claim 1, in which the flow path intermediate section is curved to form a spiral.

12. The fluid pressure reduction device of claim 11, in which the inlet section is aligned along the radial disk reference line and includes an inlet recovery zone.

13. The fluid pressure reduction device of claim 1, in which a downstream portion of the flow path intermediate section comprises first and second sub flow outlets.

14. A fluid pressure reduction device comprising:

a plurality of stacked disks having a perimeter and a hollow center aligned along a longitudinal axis;

each disk having at least one flow path extending between the hollow center and the perimeter, the flow path including an inlet section, an outlet section, and an intermediate section extending between the inlet and outlet sections;

each flow path intermediate section including a restriction and an associated recovery zone positioned immediately downstream of the restriction, wherein the restriction directs flow substantially toward a center of the associated recovery zone.

15. The fluid pressure reduction device of claim 14, in which opposing walls of the flow path intermediate section gradually diverge from one another as the flow path intermediate section advances from the inlet section to the outlet section.

16. The fluid pressure reduction device of claim 14, in which the restriction comprises a first ridge extending from a first wall of the flow path.

17. The fluid pressure reduction device of claim 16, in which the restriction further comprises a second ridge extending from a second and opposite wall of the flow path.

18. The fluid pressure reduction device of claim 17, in which the first ridge extends farther into the flow path than the second ridge.

19. The fluid pressure reduction device of claim 17, in which the first and second ridges are offset so that the first ridge is positioned upstream of the second ridge.

20. The fluid pressure reduction device of claim 14, in which each flow path comprises multiple restrictions in the intermediate section and an associated recovery zone positioned immediately downstream of each restriction, wherein each restriction directs flow substantially toward a center of the associated recovery zone and each restriction and recovery zone pair effects a pressure drop stage.

21. The fluid pressure reduction device of claim 14, in which the flow path intermediate section is curved to form a spiral.

22. A fluid pressure reduction device comprising:

a plurality of stacked disks having a periphery and a hollow center aligned along a longitudinal axis;

each disk having at least one flow path extending between the hollow center and the perimeter, the flow path including an inlet section, an outlet section, and an intermediate section extending between the inlet and outlet sections, wherein opposing walls of the flow path intermediate section diverge from one another as the flow path intermediate section advances from the inlet section to the outlet section.

23. The fluid pressure reduction device of claim 22, in which each flow path intermediate section has a generally spiral shape.

24. The fluid pressure reduction device of claim 22, in which each flow path intermediate section includes a pressure reducing structure and a recovery zone positioned immediately downstream of the pressure reducing structure.

25. The fluid pressure reduction device of claim 24, in which the pressure reducing structure comprises a pair of abrupt direction changes in the flow path.

26. The fluid pressure reduction device of claim 24, in which the pressure reducing structure comprises a restriction.

27. The fluid pressure reduction device of claim 26, in which the restriction comprises a first ridge extending from a first wall of the flow path.

28. The fluid pressure reduction device of claim 27, in which the restriction further comprises a second ridge extending from a second and opposite wall of the flow path.

29. The fluid pressure reduction device of claim 28, in which the first ridge extends farther into the flow path than the second ridge.

30. The fluid pressure reduction device of claim 28, in which the first and second ridges are offset so that the first ridge is positioned upstream of the second ridge.

31. The fluid pressure reduction device of claim 24, in which each flow path comprises multiple pressure reducing structures in the intermediate section and an associated recovery zone positioned immediately downstream of each pressure reducing structure, wherein each pressure reducing structure and recovery zone pair effects a pressure drop stage.

32. A fluid pressure reduction device comprising:

a plurality of stacked disks having a perimeter and a hollow center aligned along a longitudinal axis; and

each disk having first and second flow paths extending between the hollow center and the perimeter, the first flow path including an inlet section, an outlet section, and an intermediate section extending between the inlet and outlet sections, the second flow path having an inlet section, an outlet section, and an intermediate section extending between the inlet and outlet sections;

wherein the second flow path intermediate section and first flow path intermediate section cross at an intersection; and

wherein each of the first and second flow path intermediate sections including a recovery zone downstream of the intersection.

33. The fluid pressure reduction device of claim 32, in which the first and second flow paths are directed toward the intersection at substantially the same plane, so that fluid flowing through the first and second flow paths undergoes an abrupt direction change at the intersection.

34. The fluid pressure reduction device of claim 32, in which the first flow path includes a first ramp upstream of the intersection directed to a first plane and the second flow path includes a second ramp upstream of the intersection directed to a second plane, so that fluid flowing through the first and second flow paths creates shear forces at the intersection.

35. The fluid pressure reduction device of claim 32, in which the first flow path inlet section and the second flow path inlet section are integrally provided as a common inlet section.

36. The fluid pressure reduction device of claim 35, in which the common inlet section is aligned along a radial disk reference line extending from the axis to the common inlet section so that substantially equal volumes of fluid enter the first and second flow paths.

37. A fluid pressure reduction device comprising:

a plurality of stacked disks having a thickness and defining a perimeter and a hollow center aligned along a longitudinal axis;

each disk having at least one flow path extending between the hollow center and the perimeter, the flow path including an inlet section, an outlet section, and an intermediate section extending between the inlet and outlet sections;

wherein each flow path extends across the entire thickness of the disk to provide a through-cut flow path, each through-cut flow path dividing the disk into at least first and second blank portions.

38. The fluid pressure reduction device of claim 37, in which each disk further includes a first bridge portion extending between the first and second blank portions.

39. The fluid pressure reduction device of claim 38, in which the first bridge portion comprises an inner ring portion extending about the interior portion of the disk.

40. The fluid pressure reduction device of claim 38, in which the first bridge portion comprises an outer ring portion extending about the perimeter of the disk.

41. The fluid pressure reduction device of claim 38, in which the first bridge portion comprises a tab extending between the first and second blank portions.

42. The fluid pressure reduction device of claim 38, in which each disk further includes a second bridge portion.

43. The fluid pressure reduction device of claim 42, in which the first bridge portion comprises an inner ring portion extending about the hollow center of the disk, and the second disk portion comprises an outer ring portion extending about the perimeter of the disk.

44. The fluid pressure reduction device of claim ~~41~~ 42, in which the first and second bridge portions comprise first and second tabs extending between adjacent blank portions.

45. The fluid pressure reduction device of claim 37, in which opposing walls of each through-cut flow path intermediate section gradually diverge from one another as the flow path intermediate section advances from the inlet section to the outlet section.

46. The fluid pressure reduction device of claim 37, in which each through-cut flow path intermediate section is curved to form a spiral.

47. The fluid pressure reduction device of claim 37, in which each flow path intermediate section includes a pressure reducing structure and a recovery zone positioned immediately downstream of the pressure reducing structure.

48. A method of assembling a fluid pressure reduction device comprising:

forming a plurality of disks having at least one flow path extending between a hollow center and a perimeter of the disk, each flow path including an inlet section, an outlet section, and an intermediate section extending between the inlet and outlet sections, the flow path dividing the disk into at least first and second blank portions, each disk further including a first bridge portion extending between the first and second blank portions;

stacking the disks along an axis;

securing the stacked disks together to form a stacked disk assembly;

removing the first bridge portion of each disk in the stacked disk assembly.

49. The method of claim 48, in which the first bridge portion comprises an inner ring portion extending about the interior portion of the disk.

50. The method of claim 48, in which the first bridge portion comprises an outer ring portion extending about the perimeter of the disk.

51. The method of claim 48, in which the first bridge portion comprises a tab extending between the first and second blank portions.

52. The method of claim 48, in which the disk further includes a second bridge portion, and in which the method further comprises the step of removing the second bridge portion of each disk in the stacked disk assembly.

53. The method of claim 52, in which the first bridge portion comprises an inner ring portion extending about the interior portion of the disk, and the second disk portion comprises an outer ring portion extending about the perimeter of the disk.

54. The method of claim 52, in which the first and second bridge portions comprise first and second tabs extending between adjacent blank portions.